Technological development for infrastructure maintenance by the Ministry of Land, Infrastructure, Transport and Tourism

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He joined the Ministry of Land, Infrastructure, Transport and Tourism (then Ministry of Construction) in 1997, and served in various positions including director of the Kofu Office of River and National Highways, Kanto Regional Development Bureau, and Director for Disaster Response Planning and Coordination, Disaster Prevention and Relief Division, Water and Disaster Management Bureau, before assuming his present position in 2016.

Current status of infrastructure maintenance and necessity of technical development

In May 2014, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) announced its plan on extending the lifespan of infrastructure, which is an action plan for strategic maintenance and renovation of roads, rivers, harbors, sewer systems, and other infrastructure under its jurisdiction, and is pursuing steps such as preparing maintenance and inspection manuals in each area and developing plans for individual facilities.

There are several significant challenges in the area of infrastructure maintenance at present, including the following: [1] increase in aging infrastructure (the quantity of infrastructure built more than 50 years ago is increasing more rapidly); [2] difficulty of securing engineers to handle maintenance (in 10 years, the construction industry may lose 1.1 million skilled workers, or about one third, due to retirement, etc.); and [3] financial constraints on administrators. Therefore, it is urgently necessary to develop efficient maintenance and renovation systems by actively developing new technologies and introducing them into the field. We are engaged in interministerial efforts for technical development by means such as the SIP Infrastructure Program of the Cabinet Office.

Development of new technologies in infrastructure maintenance

In the SIP Infrastructure Program, 60 R&D projects are underway on the five topics of inspection and diagnostics technologies, materials and repair technologies, information and communications, robotics, and asset management technologies.

Of these, MLIT is conducting technical development and field verification in 23 projects involving robotics for infrastructure, in addition to inspection and diagnostics technologies in

the five areas of bridges, slopes, embankments, harbors, and airports, including the use of drones for bridge pier and floor slab inspection by photography and image analysis, the use of tilt sensors for slope displacement measurement and risk assessment, and the use of lasers and satellites to measure displacement in embankments and dams.

Three years have passed (as of June 2017) since the launch of SIP infrastructure projects, and the emphasis is expected to shift to the stage of implementation with regard to useful elemental technologies. In order to steadily advance implementation, it is necessary to promote the evaluation and certification of useful technologies through accuracy validation in order to determine whether these technologies provide the required performance that administrators are seeking at actual sites that are subject to differing weather conditions and installation environments, as well as comparison with similar technologies including their relative costs.

Faster progress from technical development to implementation: Utilization of new technologies based on NETIS

MLIT operates the New Technology Information System (NETIS), a database of technologies developed by parties such as private businesses. In the past, MLIT has promoted the practical application of these new technologies by means such as developing maintenance support sites and providing post-project evaluation of the results of utilization (recommended technologies, etc.). Starting in FY 2016, MLIT began taking steps to speed up implementation without waiting for applications from developers, by implementing the following series of steps: [1] seeking applications for new technologies on a particular topic and specifying the performance requirements sought by MLIT as administrator; [2] investigation of trial implementation of technologies for which applications are received; [3] confirmation that performance requirements are met and comparative evaluation with similar technologies; and [4] active utilization of confirmed technologies by orderers. (Fig. 1).

I believe that this will lead to significant reduction in the length of time from application and registration with NETIS to post-project evaluation, practical implementation, and widespread adoption, which has taken up to about four or five years until now, to only about one year.

In FY 2017, we plan to seek applications on a wider range of topics, including technologies to survey cavities under roads and robotic technologies that are capable of creating inspection records.

Directions for future technical development

At the present stage of technical development for maintenance, robots cannot yet substitute for inspection and diagnosis by people, and there is still an imbalance in the usable lifetime of sensors and civil engineering structures. Meanwhile, steady progress is being made toward the practical use of new technologies based on administrators' needs, including sensors to confirm the effects on durability after repairs, and robots that are capable of creating inspection records even though they cannot take over inspection and diagnosis.

In the future, efforts to introduce more advanced and efficient technologies for inspection and diagnosis and establish asset management systems for preventive maintenance based on inspection data will become the mainstay of technical development. In addition, it is essential to implement innovative technologies such as AI and IoT, which are continuing to evolve.

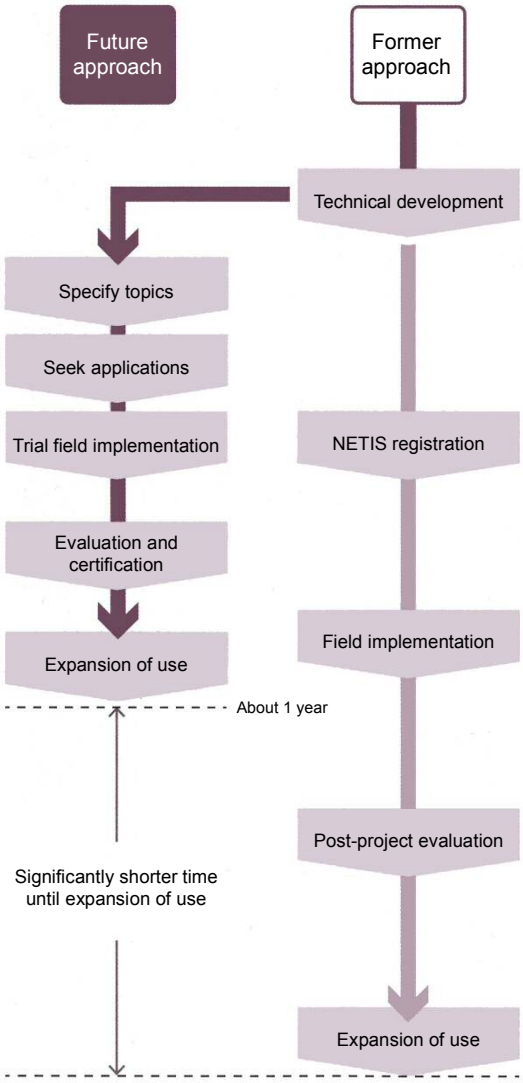

Fig. 1. Faster evaluation of new technologies by specifying development topics in NETIS

MLIT is incorporating the methods of open innovation to actively promote matching between technological solutions from different fields and the needs of administrators at venues such as the national conference on infrastructure maintenance and the i-Construction promotion consortium. In addition, we will advance the adoption of cutting-edge technologies by national and regional public organizations by providing rapid field validation and reflecting these technologies in standard inspection procedures and other standards.

Infrastructure maintenance is seen as one of the main topics for scientific and technological development in "Society 5.0" (super-smart society), and it has been selected as one of the target areas of a public/private R&D investment expansion program for innovation in science and technology which is to be launched in FY 2018. In the future, we will continue to promote the improvement of productivity in the area of maintenance while advancing the expansion of R&D investment by government and industry and promoting even closer collaboration among industry, academia, and government.